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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
NORTON, JENNIFER L	

ART UNIT	PAPER NUMBER
2121	

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10/16/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/783,495	CHEN ET AL.	
	Examiner	Art Unit	
	Jennifer L. Norton	2121	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *15 July 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1 and 3-22* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1 and 3-22* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *06 August 2004* is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

DETAILED ACTION

1. The following is a Second Non-Final Office Action in response to the Amendment received on 15 July 2008. Claim 2 has been previously cancelled. Claims 1 and 3-22 are pending in this application.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1, 3, 4, 9-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,825,912 (hereinafter Park) in view of U.S. Patent No. 6,630,362 (hereinafter Lensing).

4. As per claim 1, Park teaches a method for controlling exposure on a patterned wafer substrate, comprising the steps of:

controlling the exposure (col. 2, lines 50-55, col. 3, lines 26-28 and col. 8, lines 43-46) with a feedback process control signal (col. 3, lines 40-51, col. 4, lines 66-67, col. 5, lines 1-3, col. 8, lines 56-59 and Fig. 1, element 30) of critical dimension (col. 5, lines 35-50; i.e. line width),

and further controlling the exposure (col. 2, lines 50-55, col. 3, lines 26-28 and col. 8, lines 43-46) with a feed forward process control signal (col. 3, lines 21-25 and 29-39, col. 5, lines 13-18 and col. 8, lines 47-55 and Fig. 1, element 10) of a compensation amount that compensates for wafer thickness variations (col. 7, lines 35-45, 53-56 and 62-67, col. 8, lines 1-11 and Fig. 1, element 40), by combining the feed forward control signal with the feedback process control signal (col. 3, lines 18-20 and 51-59 and col. 8, lines 60-63) to control the exposure (col. 3, lines 60-65 and col. 8, lines 43-46), the critical dimension being one of a width, a spacing and an opening of the patterned wafer substrate (col. 5, lines 40-43).

Park does not expressly teach to exposure energy (per definition of exposure energy on pg. 1, par. [0002] of Applicant's Specification).

Lensing teaches to controlling the exposure energy in semiconductor manufacturing (col. 6, lines 56-67; i.e. controlling the exposure energy of the stepper).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of applicant's invention to modify the teaching of Park to include controlling the exposure energy in semiconductor manufacturing to detect variations and adjust parameters of equipment in the manufacture of semiconductors to correct nonconformity (col. 7, lines 23-32).

5. As per claim 3, Park teaches as set forth above supplying the feed forward process control signal by a feed forward controller (col. 5, lines 13-18 and Fig. 1, element 40).

6. As per claim 4, Park teaches as set forth above controlling the exposure energy (col. 2, lines 50-55, col. 3, lines 26-28 and col. 8, lines 43-46) by a feed forward control signal of an interlayer thickness measurement (col. 3, lines 21-24 and col. 5, lines 13-18; i.e. a silicon-nitride film of a reflection barrier layer).

7. As per claim 9, Park teaches as set forth above calculating the compensation amount according to a polynomial function with higher order coefficients set at zero (col. 7, lines 35-45, 53-56 and 62-67 and col. 8, lines 1-11).

8. As per claim 10, Park teaches as set forth above calculating the compensation amount according to a linear function (col. 7, lines 35-45, 53-56 and 62-67 and col. 8, lines 1-11).

9. As per claim 11, Park teaches as set forth above further comprising the steps calculating the compensation amount according to a segmented linear function (col. 7, lines 35-45, 53-56 and 62-67 and col. 8, lines 1-11).

10. Claims 5-8 and 12-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Park in view of Lensing in further view of U.S. Patent No. 6,798,529 (hereinafter Saka).

11. As per claim 5, Park teaches controlling the exposure energy (col. 2, lines 50-55, col. 3, lines 26-28 and col. 8, lines 43-46) by a feed forward control signal of an interlayer thickness measurement (col. 3, lines 21-24 and col. 5, lines 13-18; i.e. a silicon-nitride film of a reflection barrier layer).

Park does not expressly teach an interlayer thickness measurement remaining after chemical mechanical planarization thereof.

Lensing does not expressly teach an interlayer thickness measurement remaining after chemical mechanical planarization thereof.

Saka teaches to an interlayer thickness measurement remaining after chemical mechanical planarization.

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of Applicant's invention to modify the teaching of Park in view of Lensing to include an interlayer thickness measurement remaining after chemical mechanical planarization to continuously an in-situ, monitor localized regions of a wafer surface during the chemical mechanical planarization process (col. 5, lines 38-40).

12. As per claim 6, Park teaches calculating the compensation amount according to a polynomial function with a coefficient of the function (col. 7, lines 35-45, 53-56 and 62-67, col. 8, lines 1-11) being based on a measurement of a thickness (col. 5, lines 13-18, col. 7, lines 20-27 and col. 10, lines 5-9).

Park does not expressly teach a measurement of a remaining thickness of a planarized interlayer.

Lensing does not expressly teach a measurement of a remaining thickness of a planarized interlayer.

Saka teaches to a measurement of a remaining thickness of a planarized interlayer (col. 8, lines 61-63 and col. 13, lines 27-33).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of Applicant's invention to modify the teaching of Park in view of Lensing to include a measurement of a remaining thickness of a planarized interlayer to continuously an in-situ, monitor localized regions of a wafer surface during the chemical mechanical planarization process (col. 5, lines 38-40).

13. As per claim 7, Park teaches to calculating the feedback process control signal of critical dimension measurement of a layer (col. 5, lines 35-50; i.e. line width).

Park does not expressly teach calculating the feedback process control signal of critical dimension measurement of a top layer in a previous manufacturing lot.

Lensing does not expressly teach calculating the feedback process control signal of critical dimension measurement of a top layer in a previous manufacturing lot.

Saka teaches to calculating the feedback process control signal of critical dimension measurement of a top layer in a previous manufacturing lot (col. 12, lines 32-35).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of Applicant's invention to modify the teaching of Park in view of Lensing to include calculating the feedback process control signal of critical dimension measurement of a top layer in a previous manufacturing lot to continuously an in-situ, monitor localized regions of a wafer surface during the chemical mechanical planarization process (col. 5, lines 38-40).

14. As per claim 8, Park teaches calculating the compensation amount according to a polynomial function with a coefficient of the function (col. 7, lines 35-45, 53-56 and 62-67, col. 8, lines 1-11) being based on a measurement of a thickness of a interlayer (col. 3, lines 21-24 and col. 5, lines 13-18; i.e. a silicon-nitride film of a reflection barrier layer); and calculating the feedback process control signal of critical dimension measurement (col. 5, lines 35-50; i.e. line width).

Park does not expressly teach a measurement of a remaining thickness of a planarized interlayer; and to calculating the feedback process control signal of critical dimension measurement of a top layer in a previous manufacturing lot.

Lensing does not expressly teach a measurement of a remaining thickness of a planarized interlayer; and to calculating the feedback process control signal of critical dimension measurement of a top layer in a previous manufacturing lot.

Saka teaches to a measurement of a remaining thickness of a planarized interlayer (col. 8, lines 61-63 and col. 13, lines 27-33); and to calculating the feedback process control signal of critical dimension measurement of a top layer in a previous manufacturing lot (col. 12, lines 32-35).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of Applicant's invention to modify the teaching of Park in view of Lensing to include a measurement of a remaining thickness of a planarized interlayer; and to calculating the feedback process control signal of critical dimension measurement of a top layer in a previous manufacturing lot to continuously an in-situ, monitor localized regions of a wafer surface during the chemical mechanical planarization process (col. 5, lines 38-40).

15. As per claim 12, Park teaches a system for controlling exposure on a first patterned wafer substrate, comprising:

a feed forward controller (Fig. 1, element 40) providing a feed forward control signal (col. 5, lines 13-18) to an exposure apparatus (col. 8, lines 27-30 and Fig. 1, element 50) based on a thickness measurement of an interlayer of the first patterned wafer substrate for controlling the exposure focused on a top layer of the first patterned wafer substrate (col. 2, lines 50-55, col. 3, lines 26-28 and col. 8, lines 43-46), and

a feedback controller (col. 5, lines 38-39 and Fig. 1, element 60) providing a feedback exposure control signal (col. 5, lines 35-38 and Fig. 1, element 30) to the exposure apparatus (col. 8, lines 27-30 and Fig. 1, element 50) based on critical dimension measurement of a top layer of a patterned wafer substrate (col. 5, lines 35-50), the critical dimension being one of a width, a spacing and an opening of the patterned wafer substrate (col. 5, lines 40-43) wherein a combiner (col. 3, lines 18-21, col. 8, lines 27-30 and 60-63 and Fig. 1, element 70) combines the feed forward control signal and the feedback exposure control signal to produce a combined signal that is provided to the exposure apparatus (col. 3, lines 25-27 and 60-65 and col. 8, lines 27-30 and 43-46).

Park does not expressly teach exposure energy (per definition of exposure energy on pg. 1, par. [0002] of Applicant's Specification) and a critical dimension measurement of a top layer of a second patterned wafer substrate of a previous manufacturing lot.

Lensing teaches to controlling the exposure energy in semiconductor manufacturing (col. 6, lines 56-67; i.e. controlling the exposure energy of the stepper).

Lensing does not expressly teach exposure energy a critical dimension measurement of a top layer of a second patterned wafer substrate of a previous manufacturing lot.

Saka teaches to a critical dimension measurement of a top layer of a second wafer substrate (col. 12, lines 25-28 and col. 33, lines 4-5) of a previous manufacturing lot (col. 6, lines 58-60, col. 9, lines 28-33 and col. 12, lines 32-35).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of Applicant's invention to modify the teaching of Park to include controlling the exposure energy in semiconductor manufacturing to detect variations and adjust parameters of equipment in the manufacture of semiconductors to correct nonconformity (Lensing: col. 7, lines 23-32); and a critical dimension measurement of a top layer of a second patterned wafer substrate of a previous manufacturing lot to continuously an in-situ, monitor localized regions of a wafer surface during the chemical mechanical planarization process (Saka: col. 5, lines 38-40).

16. As per claim 13, Park teaches as set forth above a thickness measurement device (col. 5, lines 13-16 and Fig. 1, element 10) providing thickness measurement data to

the feed forward controller (col. 5, lines 16-18 and Fig. 1, element 40).

17. As per claim 14, Park teaches as set forth above a critical dimension measurement device (col. 5, lines 35-38 and Fig. 1, element 30) providing critical dimension measurement data to the feedback controller (col. 5, lines 38-39 and Fig. 1, element 60).

18. As per claim 15, Park teaches as set forth above thickness measurement device (col. 5, lines 13-16 and Fig. 1, element 10) providing thickness measurement data to the feed forward controller (col. 5, lines 16-18 and Fig. 1, element 40) and
a critical dimension measurement device (col. 5, lines 35-38 and Fig. 1, element 30) providing critical dimension measurement data to the feedback controller (col. 5, lines 38-39 and Fig. 1, element 60).

19. As per claim 16, Park teaches a thickness measurement device (col. 5, lines 13-16 and Fig. 1, element 10) providing thickness measurement data of layer (col. 3, lines 21-24 and col. 5, lines 13-18; i.e. a silicon-nitride film of a reflection barrier layer) of the first patterned wafer substrate to the feed forward controller (col. 5, lines 16-18 and Fig. 1, element 40).

Park does not expressly teach a thickness measurement device providing thickness measurement data of a shallow trench isolation layer of the first patterned wafer substrate to the feed forward controller.

Lensing teaches a thickness measurement device (col. 6, lines 22-37 and Fig. 6, element 540) providing thickness measurement of a patterned wafer substrate (col. 7, lines 23-27).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of applicant's invention to modify the teaching of Park to include a thickness measurement device providing thickness measurement of a patterned wafer substrate to detect variations and adjust parameters of equipment in the manufacture of semiconductors to correct nonconformity (col. 7, lines 23-32).

20. As per claim 17, Park teaches a critical dimension measurement device (Fig. 1, element 30) providing critical dimension measurement data (i.e. line width) of a poly-gate of wafer substrate (col. 5, lines 35-50).

Park does not expressly teach a critical dimension measurement device providing critical dimension measurement data of a poly-gate of wafer substrate of a previous manufacturing lot.

Lensing does not expressly teach a critical dimension measurement device providing critical dimension measurement data of a poly-gate of wafer substrate of a previous manufacturing lot.

Saka teaches a critical dimension measurement device providing critical dimension measurement data of a poly-gate of wafer substrate (col. 12, lines 25-28 and col. 33, lines 4-5) of a previous manufacturing lot (col. 6, lines 58-60, col. 9, lines 28-33 and col. 12, lines 32-35).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of applicant's invention to modify the teaching of Park in view of Lensing to include a critical dimension measurement device providing critical dimension measurement data of a poly-gate of wafer substrate of a previous manufacturing lot to continuously and in-situ, monitor localized regions of a wafer surface during the chemical mechanical planarization process (col. 5, lines 38-40).

21. As per claim 18, Park teaches a thickness measurement device (col. 5, lines 13-16 and Fig. 1, element 10) providing thickness measurement data of layer (col. 3, lines 21-24 and col. 5, lines 13-18; i.e. a silicon-nitride film of a reflection barrier layer) of the first patterned wafer substrate to the feed forward controller (col. 5, lines 16-18 and Fig. 1, element 40), and

a critical dimension measurement device (Fig. 1, element 30) providing critical dimension measurement data (i.e. line width) of a poly-gate (col. 5, lines 35-50).

Park does not expressly teach a thickness measurement device providing thickness measurement data of a shallow trench isolation layer of the first patterned wafer substrate to the feed forward controller and a critical dimension measurement device providing critical dimension measurement data of a poly-gate of a previous manufacturing lot.

Lensing teaches a thickness measurement device (col. 6, lines 22-37 and Fig. 6, element 540) providing thickness measurement of a patterned wafer substrate (col. 7, lines 23-27).

Lensing does not expressly teach a critical dimension measurement device providing critical dimension measurement data of a poly-gate of a previous manufacturing lot.

Saka teaches a critical dimension measurement device providing critical dimension measurement data of a poly-gate of wafer substrate (col. 12, lines 25-28 and col. 33, lines 4-5) of a previous manufacturing lot (col. 6, lines 58-60, col. 9, lines 28-33 and col. 12, lines 32-35).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of applicant's invention to modify the teaching of Park to include a thickness

measurement device providing thickness measurement of a patterned wafer substrate to detect variations and adjust parameters of equipment in the manufacture of semiconductors to correct nonconformity (Lensing: col. 7, lines 23-32); and a critical dimension measurement device providing critical dimension measurement data of a poly-gate of wafer substrate of a previous manufacturing lot to continuously and in-situ, monitor localized regions of a wafer surface during the chemical mechanical planarization process (Saka: col. 5, lines 38-40).

22. As per claim 19, Park teaches as set forth above the feed forward controller is user configurable by having one or more polynomial coefficients set to zero in a polynomial function model (col. 7, lines 35-45, 53-56 and 62-67 and col. 8, lines 1-11).

23. As per claim 20, Park teaches as set forth above the feed forward controller is user configurable by having one or more polynomial coefficients set to zero in a polynomial function model (col. 7, lines 35-45, 53-56 and 62-67 and col. 8, lines 1-11).

24. As per claim 21, Park teaches a thickness measurement device (col. 5, lines 13-16 and Fig. 1, element 10) providing thickness measurement data of layer (col. 3, lines 21-24 and col. 5, lines 13-18; i.e. a silicon-nitride film of a reflection barrier layer) of the first patterned wafer substrate to the feed forward controller (col. 5, lines 16-18 and Fig. 1, element 40).

Park does not expressly teach a thickness measurement device providing thickness measurement data of a shallow trench isolation layer of the first patterned wafer substrate to the feed forward controller.

Lensing teaches a thickness measurement device (col. 6, lines 22-37 and Fig. 6, element 540) providing thickness measurement of a patterned wafer substrate (col. 7, lines 23-27).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of applicant's invention to modify the teaching of Park to include a thickness measurement device providing thickness measurement of a patterned wafer substrate to detect variations and adjust parameters of equipment in the manufacture of semiconductors to correct nonconformity (col. 7, lines 23-32).

25. As per claim 22, Park teaches a critical dimension measurement device (Fig. 1, element 30) providing critical dimension measurement data (i.e. line width) of a poly-gate of a wafer substrate (col. 5, lines 35-50).

Park does not expressly teach a critical dimension measurement device providing critical dimension measurement data of a poly-gate of the second patterned wafer substrates of a previous manufacturing lot.

Lensing does not expressly teach a critical dimension measurement device providing critical dimension measurement data of a poly-gate of the second patterned wafer substrates of a previous manufacturing lot.

Saka teaches a critical dimension measurement device providing critical dimension measurement data of a poly-gate of the second patterned wafer substrates (col. 12, lines 25-28 and col. 33, lines 4-5) of a previous manufacturing lot (col. 6, lines 58-60, col. 9, lines 28-33 and col. 12, lines 32-35).

Therefore, it would have been obvious to a person of ordinary skill in the art at the time of applicant's invention to modify the teaching of Park in view of Lensing to include a critical dimension measurement device providing critical dimension measurement data of a poly-gate of the second patterned wafer substrates of a previous manufacturing lot to continuously and in-situ, monitor localized regions of a wafer surface during the chemical mechanical planarization process (col. 5, lines 38-40).

Response to Arguments

26. Applicant's arguments see Remarks pg. 6, filed 15 July 2008 with respect to claims 1, 3, 4 and 9-11 under 35 U.S.C. 102(b) have been considered but are moot in view of the new ground(s) of rejection.

27. Applicant's arguments see Remarks pgs. 7-10, filed 15 July 2008 with respect to claims 5-8, 12-22 under 35 U.S.C. 102(b) have been considered but are moot in view of the new ground(s) of rejection of claims 1 and 12 under 35 U.S.C. 103(a).

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

The following references are cited to further show the state of the art with respect to manufacturing semiconductors.

U.S. Patent Publication No. 2008/0154420 discloses a method of controlling one or more critical dimension (CD) features, dependent upon at least a first and a second processing parameter, with a single metrology step, while still enabling decoupled feedback to the first and the second processing parameter.

U.S. Patent Publication No. 2008/0167744 discloses a TL performs a feed forward control and a feedback control of a PM.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jennifer L. Norton whose telephone number is (571)272-3694. The examiner can normally be reached on 9:00-5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Albert Decady can be reached on 571-272-3819. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Albert DeCady/
Supervisory Patent Examiner
Art Unit 2121